

REMARKS

This application has been reviewed in light of the Office Action dated December 17, 2007. Claims 9-15 are presented for examination, of which Claim 9 is in independent form. Claims 1-8 have been canceled without prejudice of disclaimer of the subject matter presented therein, and new claims 9-15 have been added to provide Applicant with a more complete scope of protection. Favorable consideration is requested.

The drawings were objected to under 37 C.F.R. § 1.83(a) for allegedly failing to show every feature of the invention specified in the claims. In particular, the ‘through-contacts’ were deemed not shown in the drawings. Submitted herewith is an Annotated Drawing sheet showing changes to Figs. 1 and 3, as well as a Replacement Sheet of drawings incorporating the changes to Figs. 1 and 3. On the Annotated Sheet the reference numerals corresponding to changes to the drawings have been circled. In annotated Fig. 1, through-contacts 13 have been added. In annotated Fig. 3, through-contacts 13 and the insulation layer 14 have been added. Applicant submits that the amendments to the drawings add no new matter to the original disclosure, and support for the amendments may be found in the original specification (*see*, for example, paragraph [0019] with respect to the through-contacts). Approval of the amended drawings is respectfully requested. Applicant submits that the drawings are in compliance with 37 C.F.R. § 1.83(a) and that the objection has been obviated. Withdrawal of the objection is therefore respectfully requested.

In paragraph 4 of the Office Action the specification was objected to for failing to provide proper antecedent basis for the claimed subject matter of Claim 8. In particular, the phrase “through-contacts have a diameter of less than 100 $\mu$ m” of Claim 8

was objected to as lacking supporting disclosure in the specification. While cancellation of Claim 8 renders the objection moot, Applicant submits that the phrase is supported at least by paragraph [0019] of the originally filed specification.

Claims 1-8 were objected to for various informalities listed in paragraphs 6-13 of the Office Action. Cancellation of Claims 1-8 renders the objections moot. Furthermore, Applicant submits that new Claims 9-15 are in the proper form and have been drafted with particular attention to the points raised in paragraphs 6-17 of the Office Action. With respect to paragraph 7 of the Office Action Applicant submits that the phrase “die attach” is used at least, for example, in paragraph 3 of the originally filed specification, and that no grammatical change is believed necessary for this phrase. Furthermore, with regard to the points raised in paragraph 12 of the Office Action concerning claims 6-8, Applicant submits that new Claim 13 does further limit the light emitting diode of new Claim 9 by further specifying how one or more of such devices can be arranged.

Claims 1-8 were rejected under 35 U.S.C. § 112, second paragraph, for the reasons given in paragraphs 17 and 18 of the Office Action. Cancellation of claims 1-8 renders these rejections moot. New Claims 9-15 have been carefully drafted to ensure that they conform fully to the requirements of Section 112, second paragraph, with special attention to the points raised in paragraphs 18-31 of the Office Action. Accordingly, Applicant submits that new Claims 9-15 are believed to be in compliance with 35 U.S.C. § 112, second paragraph.

Claim 1 was rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent Application Publication No. 2002/0063301 (*Hanamoto et al.*). Claims 1, 2, and 5-

were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent Application Publication No. 2002/0139990 (*Suehiro et al.*). Claims 3 and 4 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Hanamoto* in view of U.S. Patent Application Publication No. 2004/0099874 (*Chang et al.*).

Cancellation of Claims 1-8 renders their rejections moot. Applicant submits that independent Claim 9, together with the claims dependent therefrom, are patentably distinct from the cited references for at least the following reasons.

The aspect of the present invention set forth in Claim 9 is directed to a light emitting diode. At least one light emitting diode die is arranged on a light emitting diode printed circuit board by means of a die attach, the light emitting diode printed circuit board comprising at its bottom surface rear side contacts. The rear side contacts at least partially overlap with the contours of the light emitting diode die and are formed in such a way as to overlap with at least half of the bottom surface of the printed circuit board. Also, the printed circuit board comprises a plurality of through-contacts thermally and electrically connecting the rear side contacts to contact areas formed on the upper surface of the printed circuit board.

Among other notable features of the apparatus of Claim 9 are the rear side contacts. In an example embodiment of the invention, the rear side contacts being arranged at least partially below the contour of the light emitting diode (LED) die, heat dissipation of the LED can be enhanced. Moreover, since a plurality of through-contacts is provided in the printed circuit board (PCB), thereby thermally and electrically connecting the contact areas and the rear side contacts of the PCB, heat dissipation of the LED can be significantly enhanced.

*Hanamoto* apparently relates to a semiconductor LED device that can emit light having a plurality of emission wavelengths, and which purportedly achieves favorable color tones without affecting human bodies and suffers almost no deterioration. Heat management or heat discharge from a semiconductor is not mentioned to any extent throughout the whole description of *Hanamoto* and does not appear to correspond at all to the subject matter of the present application.

Furthermore, Figure 14a of *Hanamoto*, relied upon in the Office Action, does not teach or suggest the above-noted features of Claim 9. The Office Action suggests that *Hanamoto* discloses rear side contacts which cover over at least half the area of the LED PCB (18). However, nothing in *Hanamoto* discloses an amount of PCB area covered by any rear side contact. Moreover, Figure 14a is merely a schematic drawing and nothing in *Hanamoto* indicates whether any features shown in that drawing are to scale. The cross sectional view of Fig. 14a does not allow an assessment of whether any alleged rear side contacts of the PCB (18) really cover at least half of the PCB surface. Indeed, such an assessment would only be possible in a plan (top) view or when having an additional cross-sectional view of the rear side contacts, and if there were information provided indicating whether the drawing was drawn to scale. However, no such additional views or information are seen to be provided. Therefore, Figure 14a cannot teach or suggest “rear side contacts ... formed in such a way as to overlap with at least half of the bottom surface of the printed circuit board”, as recited in Claim 9. Neither does that reference teach or suggest “rear side contacts at least partially overlap with contours of the light emitting diode die”, as recited in Claim 9.

Also, Figure 14a of *Hanamoto* does not teach or suggest that “the printed circuit board comprises a plurality of through-contacts thermally and electrically connecting the rear side contacts to contact areas formed on the upper surface of the printed circuit board”, as recited in Claim 9. As Applicant understands the schematic of Figure 14a, at most one through-contact is connected to each electrode section (18a, 18b), whereas in Claim 9 a plurality of through-contacts is provided for connecting the rear side contacts to contact areas.

*Suehiro*, as understood by Applicant, apparently relates to a flip chip arrangement of an LED (2) being disposed on a substrate (3) having a through hole (5), wherein one of the rear surface electrodes (4) of the light emitting element is connected on the through hole and the other one of the rear surface electrodes of the light emitting element is connected to a conductive pattern insulated from the through hole. However, *Suehiro* is not seen to disclose or suggest a plurality of through-contacts provided in the PCB.

Moreover, similar to the deficiency with respect to *Hanamoto*, the arrangement shown in Figures 2a and 2b of *Suehiro* does not reveal whether the schematically shown conductive pattern of the PCB (3) really covers at least half of the PCB surface (see also, *Suehiro*, Figs. 8 and 9). Therefore, *Suehiro* does not teach or suggest the feature that rear side contacts are formed in such a way as to overlap with at least half of the surface of the PCB. Indeed, nothing has been found, or pointed out, in *Suehiro*, that would teach or suggest “the rear side contacts at least partially overlap with the contours of the light emitting diode die and are formed in such a way as to overlap with at least half of the bottom surface of the printed circuit board”, much less “the printed

circuit board comprises a plurality of through-contacts thermally and electrically connecting the rear side contacts to contact areas formed on an upper surface of the printed circuit board,” as set forth in Claim 9.

Accordingly, Applicant submits that Claim 9 is patentable over the cited references.

A review of the other art of record, including *Chang et al.*, has failed to reveal anything which, in Applicant’s opinion, would remedy the deficiencies of the art discussed above, as references against the independent claim herein. That claim is therefore believed patentable over the art of record.

The other new claims in this application depend from Claim 9 and are submitted to be patentable for at least the same reasons. Because each dependent claim also is deemed to define an additional aspect of the invention, individual consideration of the patentability of each claim on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and early passage to issue of the present application.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

  
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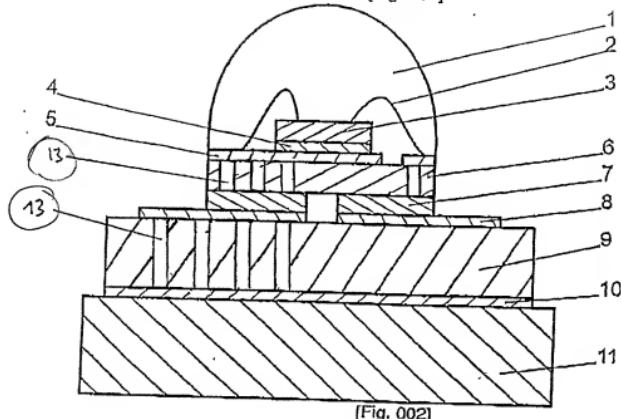
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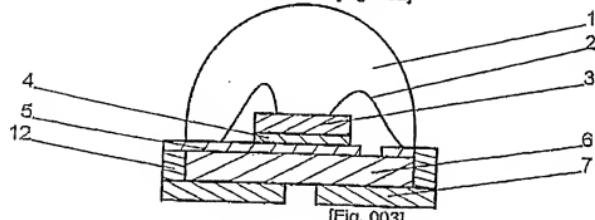
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[Fig. 001]



[Fig. 002]



[Fig. 003]

